

# (12) UK Patent Application (19) GB (11) 2 293 446 (13) A

(43) Date of A Publication 27.03.1996

(21) Application No 9418801.8

(22) Date of Filing 17.09.1994

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(51) INT CL<sup>6</sup>  
F28D 5/00

(52) UK CL (Edition O )  
F4U U25A

(56) Documents Cited  
GB 1564980 A

(58) Field of Search  
UK CL (Edition M ) F4U U25A U25B , H1K  
INT CL<sup>5</sup> F28D

## (54) Cooling assembly

(57) A cooling assembly comprises a solid state heat conductor 1 energised by connection to a DC power source to have a cool surface flatly contacting plate 3. Heat pipes 2 are clamped in grooves 31 of plate 3 by similarly-grooved fixing plate 4 using bolts 41 in insulating bushes 42. Heat is dissipated from the other ends of the heat pipes by fins 7 or other cooling means. The assembly may be used in a car refrigerator. Reversal of power source polarity enables the assembly to act as a heater. Heat pipes 2 have an inner surface coated with porous wick material.

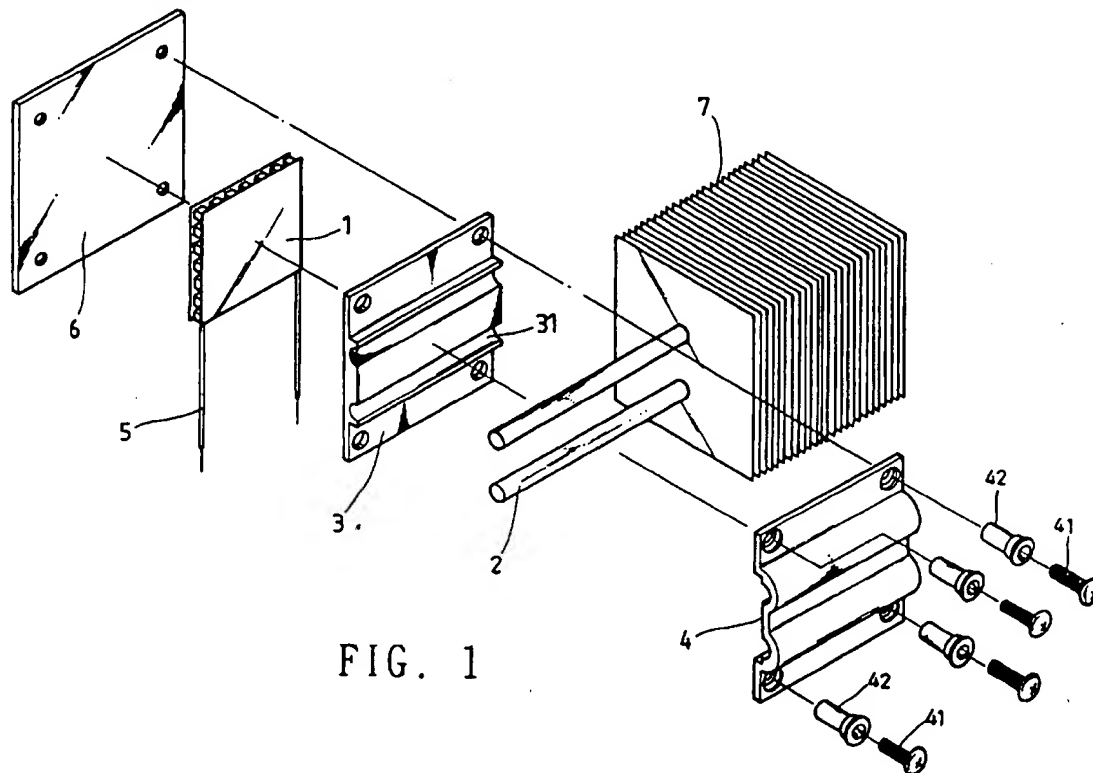


FIG. 1

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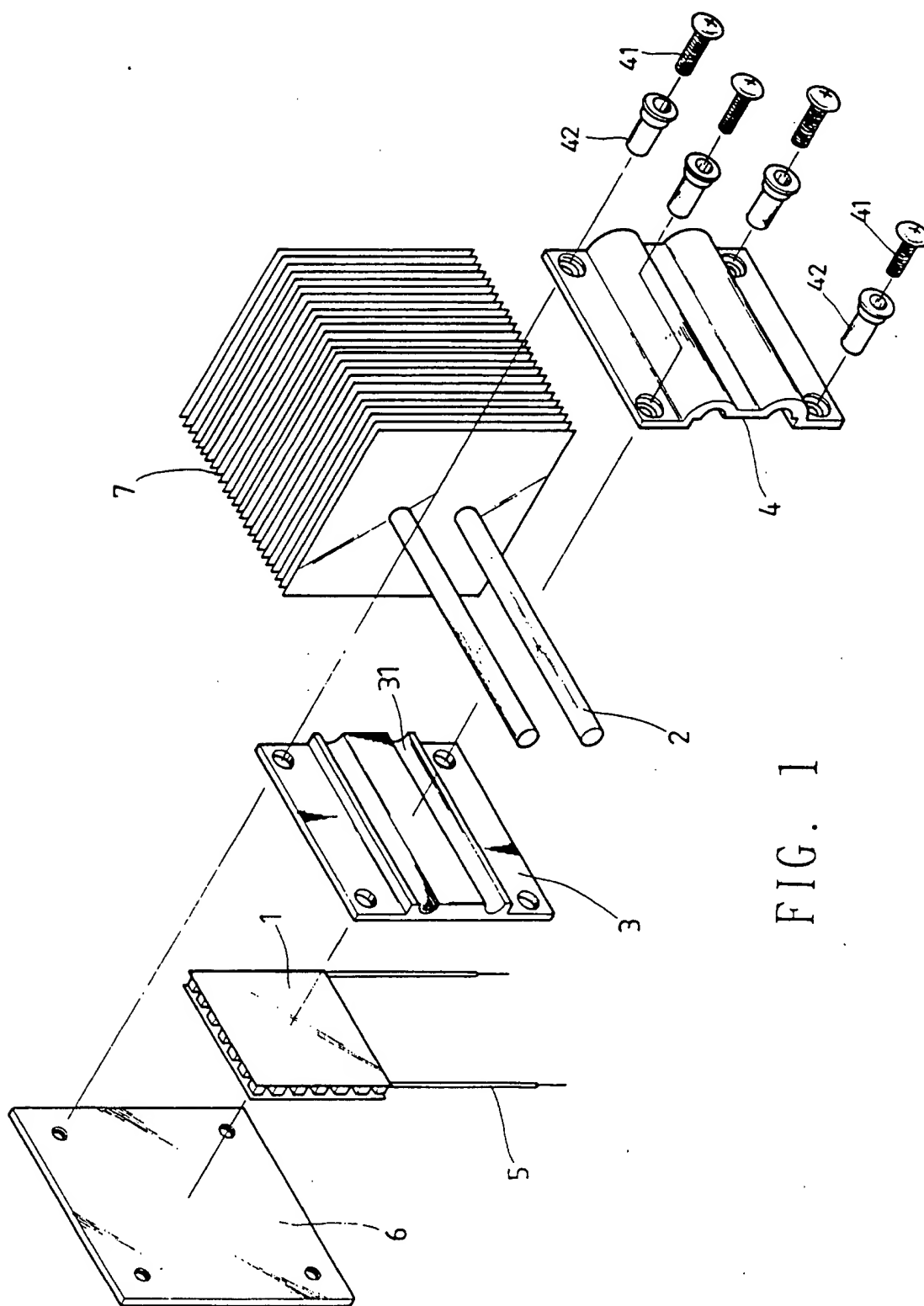


FIG. 1

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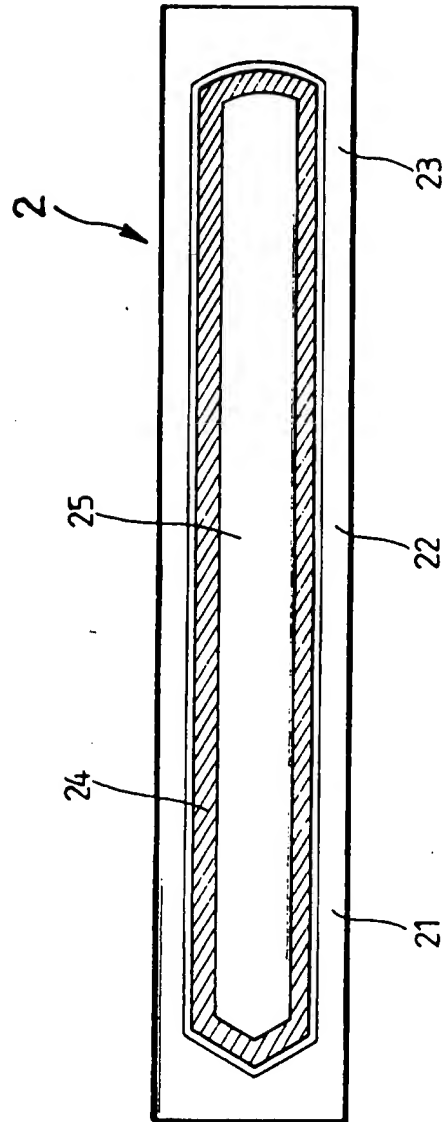


FIG. 2

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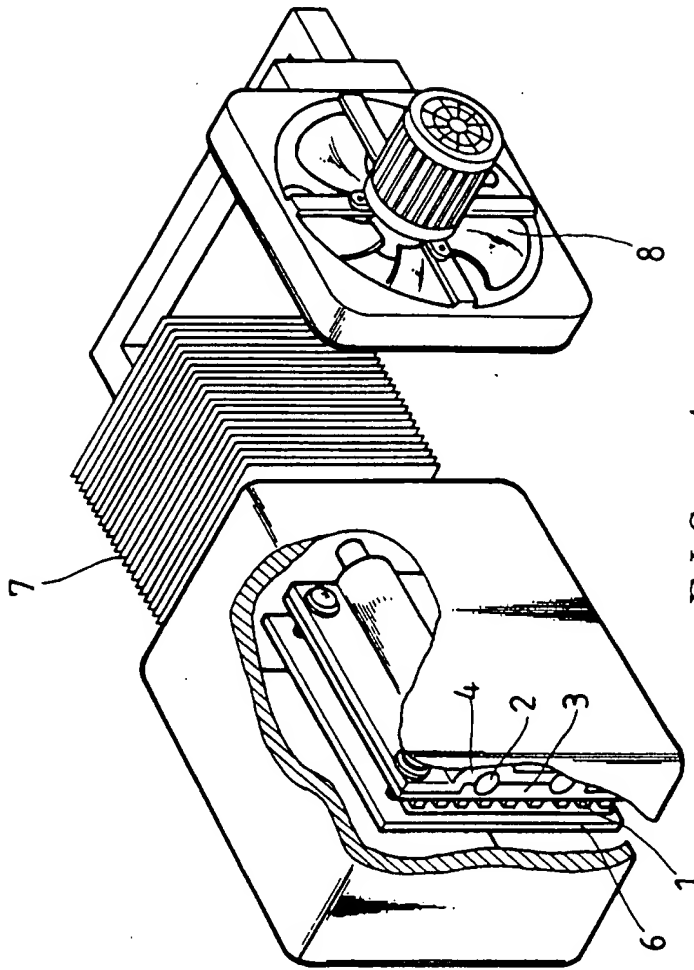


FIG. 4

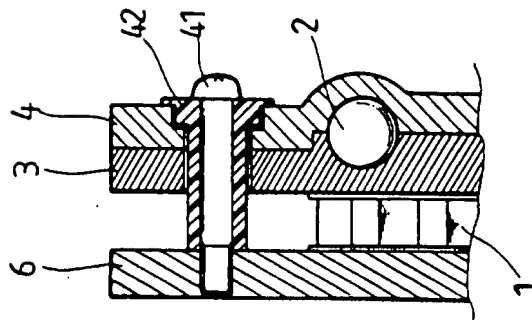


FIG. 3

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A COOLING ASSEMBLY SUITABLE FOR HEAT TRANSFER

BACKGROUND OF THE INVENTION

5 The present invention relates to a cooling assembly suitable for heat transfer and mainly includes a thermoelectric heat pump (solid state cooling with thermoelectrics) and heat pipes. Heat produced by the thermoelectric heat pump is transferred by the heat pipes from one end to the other end  
10 thereof and is then quickly conducted and dissipated to the atmosphere through air or liquid circulating cooling. Additional sets of heat pipes according to the present invention may be used to more effectively conduct the produced heat to enhance the performance of the thermo-  
15 electric heat pump.

SUMMARY OF THE INVENTION

The cooling assembly suitable for heat transfer according to  
20 the present invention mainly consists of a thermoelectric heat pump (solid state cooling with thermoelectrics), at least a set of heat pipes, a radiator base plate, and a fixing plate. The thermoelectric heat pump is connected to a DC power source and is thereby energized to form a cold  
25 and a hot surface on each side thereof to respectively contact a cooling medium and a plane surface of the radiator base plate. The heat pipes are received between semi-circular grooves formed on another side of the radiator base plate and on the fixing plate. Screws and  
30 corresponding insulating bushes are used to connect the cooling medium, the radiator base plate, and the fixing plate together with the thermoelectric heat pump fitly sandwiched between the cooling medium and the radiator base plate.

## BRIEF DESCRIPTION OF THE DRAWINGS

The structure and function of the present invention can be best understood through the following detailed description of the preferred embodiments and the accompanying drawings, wherein:

- Fig. 1 is an exploded perspective of the present invention;
- Fig. 2 is a sectional view of the heat pipe of the present invention;
- Fig. 3 is a partial, assembled vertical section of the present invention; and
- Fig. 4 shows an application of the present invention to an automobile refrigerator.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Please refer to Fig. 1 in which an exploded perspective of the present invention is shown. The present invention mainly includes a thermoelectric heat pump 1 (solid state cooling with thermoelectrics), at least a set of heat pipes 2, a radiator base plate 3, and a fixing plate 4.

The thermoelectric heat pump 1 is made of extremely pure alloy of Bismuth (Bi) and Tellurium (Te) to form P-type and N-type electric couplers for connecting an external DC power source 5. When the thermoelectric heat pump 1 is energized, a cold surface (that is, according to the principle of energy transmission, a surface absorbing heat) and a hot surface (that is, according to the principle of energy

transmission, a surface emitting heat) are separately formed at one side thereof. The cold surface is the face of the thermoelectric heat pump 1 which flatly contacts a cooling medium 6 abutting on one side of the thermoelectric heat pump 1, and the hot surface is the face of the thermoelectric heat pump 1 which flatly contacts a plane side of the radiator base plate 3.

The radiator base plate 3 is capable of heat conduction and is so constructed that one side of which is provided with two grooves 31 for each receiving a heat pipe 2 therein while the other side of which is completely plane.

As shown in Fig. 2, the heat pipe 2 each consists of three sections, namely, an evaporator section 21, an adiabatic section 22, and a condenser section 23. The adiabatic section 22 is a heat conduction path located between the evaporator section 21 and the condenser section 23, serving only as a heat transmission travel without apparent temperature difference during the quick heat transmission.

The heat pipe 2 has an inner surface coated with a layer of porous wick 24. A vapor space 25 is formed inside the heat pipe 2 surrounded by the wick-coated inner surface.

The evaporator sections 21 of the heat pipes 2 are mounted in the grooves 31 of the radiator base plate 3 and are covered by the fixing plate 4 which is provided with two matching grooves for receiving the heat pipes 2. Screws 41 are used to fix and fasten the cooling medium 6, the radiator base plate 3, and the fixing plate 4 together. Furthermore, as shown in Fig. 3, each of the screws 41 is used together with an insulating bushes 42 when it is

threaded through the radiator base plate 3 and the fixing plate 4, lest any heat energy should be transferred from the fixing plate 4 to the surface of the cooling medium 6 through the screws 41 and reversely affect the cooling effect of the cooling medium 6. A plurality of cooling fins 7 are provided at the free end of the condenser section 23 to dissipate any produced heat.

A cooling assembly constructed according to the present invention can be widely applied to many different usages by just connecting it to a common DC power source. Following is an embodiment of the present invention applied to an automobile refrigerator.

Please refer to Fig. 4. The cooling medium 6 (that is, the refrigerator) flatly contacts the cold surface of the thermoelectric heat pump 1 and the radiator base plate 3 flatly contacts the hot surface of the thermoelectric heat pump 1. When the thermoelectric heat pump 1 is connected to a DC power source 5 and energized, the cold surface and the hot surface are separately formed on one side of the thermoelectric heat pump 1. Heat produced by the hot surface is conducted to and absorbed by the evaporator section 21 (or the heat absorption section) of the heat pipe 2 via the radiator base plate 3. Heat absorbed by the evaporator section 21 is quickly conducted to the condenser section 23 (or the heat dissipation section) and dissipated into the atmosphere by means of cooling fins 7 and/or a cooling fan 8, or any other suitable cooling means, so that heat produced by the cooling medium 6 (refrigerator) can be quickly absorbed by the cold surface of the thermoelectric heat pump 1 to cool the articles stored in the refrigerator. The lower the temperature of the cold surface is, the easier

the heat produced by the cooling medium 6 is absorbed by the cold surface of the thermoelectric heat pump 1 to achieve the desired cooling or freezing effect.

- 5     What should be noted is the dissipation of heat in the present invention is not limited to the air cooling. It is no doubt that water-cooling by circulating water or connection of additional set or sets of heat pipes can be implemented as necessary to achieve the same cooling effect.
- 10    However, the manners of cooling is not part of claims of the present invention. General ways of heat dissipation, such as air-cooling, water-cooling, or any other similar ways can be adopted in the present invention.
- 15    Another thing to be noted is that since the phenomena of heat absorption (that is, the feeling of cold) or heat emission (that is, the feeling of hotness) will appear when a direct current passes through two different types of metal or conductors, it is possible to cause a reverse phenomena
- 20    when the direct current passes through the conductors in a reverse direction. In other words, when the direct current passes the conductors in a reverse direction, the cold surface and the hot surface formed on the thermoelectric heat pump 1 (solid state cooling with thermoelectrics) shall
- 25    exchange their positions. And, the cooling medium becomes a heating medium; the heat absorption (evaporator) section 21 becomes a heat dissipation (condenser) section. Due to the exchangeability of polarity of a power source and the resulted reversible cold and hot surface of the
- 30    thermoelectric heat pump, the present invention can be widely applied to a cooling or a heating medium via general DC power source. In other words, the present invention can be designed to be a cooling system or a heating system

depending on the actual need. Moreover, more than one set of heat pipes can be mounted to contact the hot surface of the thermoelectric heat pump at the same time. Each set of the heat pipes may consist of one single pipe, dual pipes, or multiple pipes, depending to the need of the corresponding cooling or heating medium.

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What is claimed is:

A cooling assembly suitable for heat transfer, comprising a thermoelectric heat pump (solid state cooling with thermoelectrics), at least a set of heat pipes, a radiator base plate, and a fixing plate;

said thermoelectric heat pump (solid state cooling with thermoelectrics) being connected to a DC power source and having a cold surface and a hot surface separately formed on each side thereof when it is energized, said cold surface being a side of said thermoelectric heat pump flatly contacting a surface of a cooling medium, and said hot surface being another side of said thermoelectric heat pump flatly contacting a plane surface of said radiator base plate;

said radiator base plate being so formed that it has a plane surface at one side and a grooved surface at another side for receiving heat pipes in grooves formed on said radiator base plate;

said heat pipes each consisting of an evaporator section, a condenser section, and an adiabatic section between said evaporator and said condenser sections; said evaporator section being received in said groove of said radiator base plate, and said condenser section being connected to a cooling system; and

said fixing plate being formed with grooves corresponding to said grooves on said radiator base plate such that said cooling medium, said radiator base plate, and said fixing

plate may be joined together by means of screws and corresponding insulating bushes to fitly sandwich said thermoelectric heat pump between said cooling medium and said radiator base plate and clamp said heat pipes between  
5 said radiator base plate and said fixing plate.

**Patents Act 1977**  
**Examiner's report to the Comptroller under Section 17**  
**The Search report)**

Application number  
 GB 9418801.8

**Relevant Technical Fields**

- (i) UK Cl (Ed.M)      F4U: U25A, U25B; H1K  
 (ii) Int Cl (Ed.5)      F28D

Search Examiner  
 MR G WERRETT

Date of completion of Search  
 22 NOVEMBER 1994

**Databases (see below)**

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-

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(ii)

**Categories of documents**

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| <p><b>X:</b> Document indicating lack of novelty or of inventive step.</p> <p><b>Y:</b> Document indicating lack of inventive step if combined with one or more other documents of the same category.</p> <p><b>A:</b> Document indicating technological background and/or state of the art.</p> | <p><b>P:</b> Document published on or after the declared priority date but before the filing date of the present application.</p> <p><b>E:</b> Patent document published on or after, but with priority date earlier than, the filing date of the present application.</p> <p><b>&amp;:</b> Member of the same patent family; corresponding document.</p> |
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Category	Identity of document and relevant passages	Relevant to claim(s)
A	GB 1564980 (SONY) whole document	1

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